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[Bleaching activator and process for using the activator
]BLEACHING ACTIVATOR AND PROCESS FOR USING THE ACTIVATOR

FIELD OF THE INVENTION

[0001] The invention relates to a bleaching activator for improving the opacity of bleached pulps containing lignin, and to a method for using the activator.

BACKGROUND OF THE INVENTION

[0002] In the description of the background of the present invention that follows reference is made to certain structures and methods, however, such references should not necessarily be construed as an admission that these structures and methods qualify as prior art under the applicable statutory provisions. Applicants reserve the right to demonstrate that any of the referenced subject matter does not constitute prior art with regard to the present invention.

[0003] Opacity is used to describe the nontransparent aspect of paper, which, along with brightness, is an important property of pulp in paper manufacture. Almost invariably, however, the opacity of the pulp decreases when the brightness increases. At present, mechanical pulps are more and more often bleached with hydrogen peroxide. Dithionite bleaching is also used either alone or together with peroxide bleaching, whereupon dithionite is either used as refiner bleaching or after-bleaching. In the peroxide bleaching of pulp, mechanical pulp in particular, the decrease of opacity is clearly detectable, while the dithionite bleaching does not necessarily decrease the opacity. Generally, the lighter the level of bleaching the

pulp, the lower the opacity of the pulp. The appended Fig. 1 that shows a variation in the opacity of spruce TMP, when peroxide is used to bleach pulp to various degrees of brightness manifests this. In certain paper grades, opacity is an important property. If we want to advance peroxide bleaching at the expense of dithionite bleaching, it would be important to be able to optimize peroxide bleaching so that the opacity remains as high as possible while the brightness grows.

[0004] Generally, the chemicals used in the peroxide bleaching of mechanical pulps are hydrogen peroxide, lye (alkali), and waterglass. The purpose of the base is to increase the pH to a sufficiently high level, so that the hydrogen peroxide, which works as the actual bleaching agent, is dissociated producing perhydroxyl anions. The purpose of the waterglass is to stabilize the hydrogen peroxide.

[0005] We have observed that peracetic acid treatment, for example, can provide a clearly higher opacity with the same level of brightness than when pulp is bleached with hydrogen peroxide alone.

[0006] Peracetic acid can also be produced in situ, for example, from acetanhydride or TAED (tetra acetyl ethylene diamine) or some other corresponding activator. One disadvantage of TAED is its high price and that it is a solid substance. It would be necessary to disperse the TAED in water before use, which makes it difficult to use. Furthermore, TAED contains nitrogen, which might constitute a problem for environmental protection. Acetanhydride is relatively cheap, but it would cause odour nuisance and be an inconvenient substance from the point of view of industrial safety. In addition, when fed into an alkaline bleaching

solution (NaOH + H_2O_2 + waterglass), it would readily cause silicate precipitate and consume the lye.

[0007] Paper manufacture aims at ever-higher brightness levels. The brightness of paper can be affected, for example, by treating the paper with coating agents containing, among other things, pigments, binding agents, and plasticizing agents (JP [application] Application 284598). However, the use of several coating agents at the final stage of paper manufacture adds to the manufacturing costs.

[0008] A technically useful activator should be liquid and stable, and it should preferably have a suitable pH value, so that no silicate precipitate would form in the alkaline peroxide bleaching. Because of environmental matters, a nitrogen-free activator would provide an additional benefit. The additive of the bleaching should also be cost-effective for the paper manufacturers. Consequently, an activator should be found for pulp bleaching, which, to fulfil the conditions mentioned above, is a registered, reasonable, commercial chemical that is easy to get and can be added to the pulp as early as at the peroxide bleaching stage. Furthermore, attention should also be paid to the other effects of the substance, such as applicability in plant conditions.

SUMMARY OF THE INVENTION

[0009] The purpose of this invention is to find a useful activator that is used in pulp bleaching and that [fulfils] fulfills the conditions mentioned above.

[The main features of the invention are disclosed by the appended Claims.]

[0010] According to one aspect, the present invention provides a peroxide bleaching solution for bleaching paper pulp comprising: lignin, and a bleaching activator comprising a mono-, di- or triformic, acetic or propionic ester of glycerol.

BRIEF DESCRIPTION OF THE DRAWING

[0011] Fig. 1 is a plot showing brightness vs. opacity when peroxide is used to bleach pulp.

DETAILED DESCRIPTION OF THE INVENTION

[0012] According to the invention, we have surprisingly observed that carboxylic acid esters of glycerol known per se are very suitable to be used as activator agents. From the point of view of industrial hygiene, the carboxylic acid esters of glycerol are almost harmless. Useful carboxylic esters of glycerol include the monoesters, diesters, and triesters of formic acid, acetic acid, and propionic acid in particular. Especially preferable activator agents to be added to the bleaching process comprise acetic esters of glycerol, such as triacetine and diacetine. Even if these esters as such were not water soluble, they dissolve completely in an alkaline peroxide solution, because the acetyl groups split off producing percarboxylic acid in situ. Glycerol and carboxylic acid are the residues of the chemical. By default, bleaching produces glycerol and acetic acid.

[0013] Activators according to the invention include mono-, di- and triformic, acetic and propionic esters of glycerol. Mono-, di- and triacetic esters of glycerol are preferable.

[0014] As it is assumed that the generation of peracid in peroxide bleaching is the reaction mechanism of the activator, the excess length of the hydrocarbon chain reduces the effect of the activator. When the hydrocarbon chain increases, a smaller amount of peracid is obtained as the amount of material than with shorter hydrocarbon chains.

[0015] A suitable dose of the activator has been found to be 0.2–5 kg/ton of pulp. A preferable dosage is 1–3 kg/ton of pulp. The bleaching conditions can be normal; in bleaching mechanical pulps, for example, we have used a temperature of 50-90°C, a consistency of 5–40%, and a retention of 30–240 min. Depending on the level of brightness, the dose of peroxide may vary within 5–50 kg/ton of pulp. Correspondingly, the doses of lye and waterglass must be adjusted to be suitable for the dose of peroxide. In addition to lye, waterglass, and hydrogen peroxide, the bleaching solution can contain a chelating agent, such as DTPA or some other stabilizers. The activators are suitable to be used for bleaching mechanical pulps in particular, such as ground wood (SGW, PGW), refiner mechanical pulp (TMP) or chemi-mechanical pulps (CTMP). Activators can also be used in the peroxide bleaching of chemical pulps, such as sulphate and sulphite pulp. The sort of wood used for the manufacture of pulp has no significance for the functioning of the invention.

[0016] In the following, the invention is described mainly with the aid of [examples] Examples 1 to 4.

Example 1

[0017] Chemi-mechanical pulp (CTMP) was treated with peroxide in a normal manner. The effect of the bleaching activator is shown in Table 1.

Table 1

[0018] CTMP, bleaching solution: 24 kg of NaOH + 20 kg of waterglass + 30 kg/ton of pulp of H_2O_2

t = 70°C, consistency 30%, 120 min, chelated pulp

Activator	Dosage, kg/ton of pulp	Brightness, % ISO	Yellowness	Opacity
None	-	78.4	17.7	64.9
PAA	2	79.1	17	67.2
Triacetine	5	78	17.9	67.2
Triacetine	2	78.3	17.8	68.6

[0019] The results indicate that by adding the activator to the peroxide bleaching, a distinctly higher opacity with the same brightness level is achieved than by using peroxide bleaching alone. The results also show that the activators had hardly any effect on the ISO brightness.

Example 2

[0020] Refiner mechanical pulp of spruce with a brightness of 60.4% ISO, opacity of 86.5, containing 100 ppm of Mn and 18 ppm of Fe, was brought to peroxide bleaching. The results are in Table 2.

Table 2 TMP (spruce), bleaching stages

[0021] Chelating treatment: Consistency 10%, pH 5.5, 45 min, t = 55°C, 2 kg/ton of pulp of DTPA

Consistency to 15%

Peroxide bleaching: 120 min, t = 70°C, consistency 15%, 22 kg of H_2O_2, 22 kg of NaOH, 17.6 kg/ton of pulp of waterglass

Activator	Dosage kg/ton of pulp	H_2O_2 residue, kg/ton of pulp	Brightness, % ISO	Opacity, %
None	0	9.2	74.5	81.4
Triacetine	1	9.4	75.8	83.1
Triacetine	2	9.9	75.5	82.8

[0022] The results show that the activator in peroxide bleaching obviously had a positive effect on the opacity of the pulp, when compared with peroxide bleaching without the added activator.

Example 3

[0023] Pressure groundwood pulp was treated with peroxide in a normal manner. The effect of the bleaching activator is shown in Table 3.

Table 3 PGW (pressure groundwood pulp)

[0024] Peroxide bleaching: Consistency 28%, [12 0min] 120min, t = 70°C, 25 kg of H_2O_2, 18.8 kg of waterglass, 25 kg of NaOH, chelated at the plant

Triacetine, kg/ton of pulp	Brightness, % ISO	Opacity, %	Light scattering	Light absorption
0	77.5	86.4	67.4	0.37
1	77.8	87.8	70.3	0.36
2	77.8	88.6	73.9	0.37

Example 4

[0025] Mechanical pulp was treated with peroxide in a normal manner. The effect of the bleaching activator in peroxide bleaching is shown in Table 4.

Table 4

[0026] TMP, bleaching solution: 20 kg of NaOH + 18.8 kg of waterglass + 20 kg of H_2O_2, 2 kg of DTPA

t = 70°C, consistency 28%, 120 min, plant-chelated pulp

Activator	Dosage, kg/ton of pulp	Brightness, % ISO	Opacity
None	-	77.8	79.4
Triacetine	1	77.9	81.3
Triacetine	2	77.8	81.1
Triacetine	5	77.5	81.7
Diacetine	2	77.8	81.5

[0027] The results show that the activator had a distinct effect on the opacity with the same level of brightness as peroxide bleaching alone. We can also observe that the activators have no effect on the ISO brightness.

[0028] While the present invention has been described by reference to the above-mentioned embodiments, certain modifications and variations will be evident to those of ordinary skill in the art. Therefore, the present invention is limited only by the scope and spirit of the appended claims.